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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
WASHINGTON

Letter
Circular
LC 85

(January 1, 1923)

FEES FOR MAGNETIC TESTING

(The schedule of fees given in this circular supersede all previous schedules.)

Normal Induction and Hysteresis

For normal induction and hysteresis, two classes of test are now provided, designated as Class A and Class B respectively.

Class A Tests

Class A tests are made by the Burrows compensated double yoke method. This is the most accurate method available for straight bars, if the specimens are magnetically uniform along their length. For this test two bars of the same material are required, one of which is used as an auxiliary.

When the material is sufficiently uniform in dimensions and magnetic properties along its length, the values of magnetizing force corresponding to given inductions up to 14000 gausses are accurate within 2 per cent, and values of induction above 14000 gausses are accurate within 1 per cent for a given magnetizing force.

This test should only be requested for standard bars intended for use in the calibration of magnetic testing apparatus or in cases where the highest accuracy is necessary, such as the settling of disputes or in certain classes of research work. As stated above, two samples of the same material are required which must be at least 25 cm (10 inches) long and may be either round, 1.27 cm (1/2 inch) in diameter or of any uniform rectangular cross section which will pass through a hole 1.8 cm by 4 cm (3/4 inch by 1 5/8 inch).

Class B Tests

Class B tests are made by methods (generally other than the Burrows) which appear to be best adapted for the material submitted, including modifications of the single yoke, the Fahy simplex permeameter, straight solenoid with shearing curves, etc. As these methods do not require auxiliary specimens, single bars may be submitted which should conform to the same requirements as to dimensions as the samples for Class A tests.

It is usually difficult, if not impossible, to state the accuracy attained by the methods used in Class B tests, especially in the case of materials which are not magnetically uniform along their length. In general, however, values of magnetizing force corresponding to inductions up to 14000 gausses are accurate within 5 to 10 per cent and values of induction above 14000 gausses are accurate within 2 per cent for a given magnetizing force.

While the methods used in Class B tests may not be inherently as accurate on an absolute basis as that used for Class A tests, it should be borne in mind that the comparative results are just as good. Furthermore, in view of the fact that the Burrows method is liable to be affected by lack of uniformity in the specimen even more than the other methods used, and that a quantity of material which may be represented by a single specimen may vary in magnetic properties by an amount greater than the probable error of measurement, it is obvious that a Class B test is entirely satisfactory in the majority of cases even for most research purposes.

Hysteresis Tests

Values of residual induction and coercive force, or other points on the hysteresis loop can be determined by either the Class A test or a Class B test according to the condition and uniformity of the test pieces as in the case of normal induction, and with corresponding accuracy. In all hysteresis measurements one point on the normal induction curve must first be determined and used as the tip of the hysteresis loop. This point must be specified in requesting a hysteresis test. Hysteresis tests are usually made from a maximum induction of 10000 or 14000 gausses, or a maximum magnetizing force of 150 or 200 gilberts per cm according to the class of material. Permanent magnet steel should be submitted in the hardened condition.

Schedule 91. Normal Induction and Hysteresis

A. Class A tests.

(a) First value of normal induction	$5.00
(b) Each additional value of normal induction	.50
(c) Each point on the hysteresis loop ..... (the tip of the loop is taken as a value of normal induction)	1.50

B. Class B tests.

(d)	First value of normal induction	$3.00
(e)	Each additional value of normal induction	.25
(f)	Each point on the hysteresis loop (the tip of the loop taken as a value of normal induction)	.75

Core Loss

Precision Measurements

Precision measurements of core loss are made by the Lloyd method with approximately a sine wave of magnetization for maximum inductions up to and including 14000 gausses, and at frequencies of 25, 30, 50 or 60 cycles. The usual test is at 10000 gausses and 60 cycles. Values obtained by this method are correct within 2 per cent.

For this test ten small sheets approximately 30 cm (12 inches) square are required. These are cut at the Bureau into strips 5 cm by 25.4 cm, half parallel and half at right angles to the direction of rolling.

A.S.T.M. Method

Core loss determinations are also made according to the specifications of the American Society for Testing Materials. This test is made at a maximum induction of 10000 gausses and a frequency of 60 cycles. For this test 10 kilograms of strips 50 cm by 3 cm, half cut parallel and half at right angles to the direction of rolling are required. These strips should be cut to size by the person submitting the material for test. It is estimated that values obtained by this method are accurate within 5 per cent.

Schedule 93. Core Loss.

(a)	Precision measurement of core loss at one frequency and one flux density	$10.00
(b)	Each additional measurement on the same sample	1.00
(c)	Core loss test according to specifications of the American Society for Testing Materials	5.00

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This test should only be requested for standard bars intended for use in the calibration of magnetic testing apparatus or in cases where the highest accuracy is necessary, such as the settling of disputes or in certain classes of research work. As stated above, two samples of the same material are required which must be at least 25 cm (10 inches) long and may be either round, 1.27 cm (1/2 inch) in diameter or of any uniform rectangular cross section which will pass through a hole 1.8 cm by 4 cm (3/4 inch by 1 5/8 inch).

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It is usually difficult, if not impossible, to state the accuracy attained by the methods used in Class B tests, especially in the case of materials which are not magnetically uniform along their length. In general, however, values of magnetizing force corresponding to inductions up to 14000 gausses are accurate within 5 to 10 per cent and values of induction above 14000 gausses are accurate within 2 per cent for a given magnetizing force.

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(b)	Each additional value of normal induction	.50
(c)	Each point on the hysteresis loop ..... (the tip of the loop is taken as a value of normal induction)	1.50

B. Class B tests.

(d) First value of normal induction	$3.00
(e) Each additional value of normal induction	.25
(f) Each point on the hysteresis loop (the tip of the loop taken as a value of normal induction)	.75

Core Loss

Precision Measurements

Precision measurements of core loss are made by the Lloyd method with approximately a sine wave of magnetization for maximum inductions up to and including 14000 gausses, and at frequencies of 25, 30, 50 or 60 cycles. The usual test is at 10000 gausses and 60 cycles. Values obtained by this method are correct within 3 per cent.

For this test ten small sheets approximately 30 cm (12 inches) square are required. These are cut at the Bureau into strips 5 cm by 25.4 cm, half parallel and half at right angles to the direction of rolling.

A.S.T.M. Method

Core loss determinations are also made according to the specifications of the American Society for Testing Materials. This test is made at a maximum induction of 10000 gausses and a frequency of 60 cycles. For this test 10 kilograms of strips 30 cm by 3 cm, half cut parallel and half at right angles to the direction of rolling are required. These strips should be cut to size by the person submitting the material for test. It is estimated that values obtained by this method are accurate within 5 per cent.

Schedule 93. Core Loss.

(a) Precision measurement of core loss at one frequency and one flux density	$10.00
(b) Each additional measurement on the same sample	1.00
(c) Core loss test according to specifications of the American Society for Testing Materials	5.00